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PECIFICATION

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EXAMINER'S COPY

COMPLETE SPECIFICATION

Improvements in or relating to Electrical Capacitors

We, A. H. HUNT (CAPACITORS) LIMITED, a British Company, of Bendon Valley, Garratt Lane, Wandsworth, London, S.W.18, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention comprises improvements in or relating to electrical capacitors. It is concerned with capacitors, chiefly roll capacitors, of the kind wherein the dielectric comprises flexible strip material having a thin coating of metal deposited on one or both its surfaces to act as an electrode or electrodes, or wherein similar metal-coated flexible insulating strip is used in the makeup of capacitors but the strip does not itself perform duty as dielectric but is simply employed as a carrier of the metal.

With such capacitors it is normally necessary to render certain areas of the dielectric or carrier strip free of metal. Thus, in the case of roll capacitors comprising more than one length of dielectric strip each metallised on one face and wound together, or when the dielectric is metallised on both faces, this is normally done to provide a metal-free edge margin or margins in order to prevent short-circuiting between different metal layers over the edges of the strip, as explained in British Patent No. 563,080. Again in the case of a capacitor wound from a single strip of dielectric bearing a castellated pattern of metallised areas to provide two electrodes on one surface, as described in British Patent No. 647,573, a narrow deviating metal-free band must be obtained along the strip.

Hitherto, metal-free areas have been obtained by electrical demetallising technique in the manner described in the specifications of the above-mentioned patents. It has also been proposed to achieve a similar effect by masking selected areas of the strip during deposition of the metal coating.

The present invention provides a method of delimiting capacitor electrode areas on a flexible dielectric or carrier strip which is metallised over one or both of its faces, wherein the whole of each metallised face remains unmasked whilst metal-free areas are formed thereon by applying to selected parts only thereof a chemical demetallising reagent or reagents.

There are a variety of reagents that will attack thin metal films, for example hydrochloric acid, sodium hydroxide and so forth, but the preferred reagent in the present connection is sodium hydroxide. The metal coating may be of aluminium carried on a dielectric strip of polyethylene terephthalate.

The following is a description of one method of carrying the invention into effect, given by way of example, and with reference to the accompanying diagrammatic drawing. The flexible strip material to be treated is polyethylene terephthalate dielectric which has been previously metallised with aluminium all over one face. The strip 11 is drawn off from a supply spool 12 whence it passes over a guide roller 13 and then through the nip between a demetallising roller 14 and a backing roller 15 which keeps the strip in contact wtih the demetallising roller. The demetallising roller 14 is in contact with a transfer roller 16, which is somewhat below the demetallising roller and has its lower part dipping into a bath 17 of 6% sodium hydroxide solution, i.e. a solution consisting of 60 parts by weight of solid caustic soda in 100 parts by weight of water. The strip 11 passes with its metallised surface against the demetallising roller, and the cylindrical surface 18 of the roller bears a pattern in relief, the raised parts of the pattern comprising those areas of the roller surface that come into contact with the

[Price 3s. 6d.]

areas of the strip that it is desired to demetallise. Therefore, said areas of the strip have applied to them a film of the sodium hydroxide reagent drawn up from the reagent bath 17 by the transfer roller 16.

The strip 11 passes on to a tank 19 of wash water but before it enters the wash tank the sodium hydroxide demetallising reagent has time to react upon the metallisation and dissolve it at those places which have been coated with the reagent. The residue of the reaction and any excess sodium hydroxide is mainly removed in the wash tank, and the washing is completed by water sprays 20 which are directed on to the surfaces of the strip after it leaves the wash tank. The strip 11 then passes through a second longer wash tank 21 and between further water sprays 22. These sprays are positioned above the wash tank so that the water from them replenishes the tank which has a continuous overflow to prevent it from containing too high a concentration of reaction products and unused reagent.

Afterwards, the strip 11 is passed through infra red drying cabinets 23 and then wound on to a take-up spool 24 which can subsequently be used as a supply reel in the manufacture of roll capacitors.

Increased production is obtained by treating a wide web of the strip material by employing a plurality of transfer rollers side by side, or a single long roller bearing a plurality of patterns, and afterwards slitting the web longitudinally into individual strips.

The solution of sodium hydroxide reagent may, if desired, have its viscosity increased, for example by the addition of a substance such as sodium silicate to improve the adherence of the reagent to the metallised areas of the strip and give a cleaner edge to the demetallised areas; preferably the viscosity is increased to a value somewhat greater than 800 centistokes. In this way a clean sharp pattern of demetallised areas is obtained which compares favourably with results achieved by electrical demetallisation or masking.

The dielectric or carrier strip bearing the metallisation need not be polyethylene terephthalate, but can be any other synthetic plastic material, or indeed any flexible strip insulating material that has sufficient resistance to the action of the demetallising reagent. Paper strip can be treated if the surfaces of the paper are firstly suitably protected by a coat of lacquer or varnish. It is also to be noted that this chemical method can be used to treat comparatively rough-surfaced strip materials which would not be amenable to treatment by electrical demetallisation; for example, woven material such as a strip of glass cloth could be used for carrying the metallisation.

It will be understood that the speed at which the strip or web can be run through the demetallising apparatus is governed by the consideration that sufficient time must be given for the metallising reagent to act during the passage of the strip between the transfer roller and the wash tank. Consequently, if this distance is increased the apparatus can be speeded up without affecting the quality of the demetallisation.

WHAT WE CLAIM IS:—

1. A method of delimiting capacitor electrode areas on a flexible dielectric or carrier strip which is metallised over one or both of its faces, wherein the whole of each metallised face remains unmasked whilst metal-free areas are formed thereon by applying to selected parts only thereof a chemical demetallising reagent or reagents.

2. A method as claimed in Claim 1, wherein the dielectric or carrier strip is of a synthetic plastic material, such as polyethylene terephthalate.

3. A method as claimed in Claim 1, wherein the dielectric or carrier strip is of paper protected by a coating of a lacquer or varnish that is resistant to the demetallising reagent being used.

4. A method as claimed in Claim 1 or Claim 2 or Claim 3, wherein the demetallising reagent is an aqueous solution of sodium hydroxide.

5. A method as claimed in Claim 4, wherein the concentration of sodium hydroxide in the solution is approximately 60% by weight as herein defined.

6. A method as claimed in Claim 4, or Claim 5, wherein the sodium hydroxide solution has its viscosity increased, by the addition of a substance such as sodium silicate, to a value of 800 centistokes or more.

7. A method as claimed in any one of the preceding claims, wherein the metallisation on the flexible dielectric or carrier strip is aluminium.

8. A method as claimed in any one of the preceding claims, wherein the reagent is applied to the metal-coated surface of the dielectric or carrier strip by a demetallising wheel or roller with a patterned periphery which has reagent transferred to it from a reagent bath.

9. A method as claimed in Claim 8, wherein after treatment with the reagent the strip passes to stations where it is first washed to remove surplus reagent and reaction products, and then dried.

10. A method as claimed in Claim 9, where at the washing station the strip is both sprayed by wash jets and passed through a wash tank, and wash liquid from the jets is arranged to run down into the tank which has a continuous overflow, whereby concentration of reaction products and unused reagent in the tank is prevented.

11. A method of delimiting capacitor electrode areas on a flexible metallised dielectric

or carrier strip substantially as herein described with reference to, and as shown in, the accompanying diagrammatic drawing.

12. Capacitor-electrode-bearing flexible dielectric or carrier strip whenever produced by the method according to any one of the preceding claims.

13. An electrical capacitor whenever manufactured from capacitor-electrode-bearing flexible dielectric or carrier strip according to Claim 12.

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Chartered Patent Agents.

PROVISIONAL SPECIFICATION

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We, A. H. HUNT (CAPACITORS) LIMITED, a British Company, of Bendon Valley, Garratt Lane, Wandsworth, London, S.W.18, do hereby declare this invention to be described in the following statement: —

This invention comprises improvements in or relating to electrical capacitors. It is concerned with capacitors, chiefly roll capacitors, of the kind wherein the dielectric comprises flexible strip material having a thin coating of metal deposited on one or both its surfaces to act as an electrode or electrodes, or wherein similar metal-coated flexible insulating strip is used in the make-up of capacitors but the strip does not itself perform duty as dielectric but is simply employed as a carrier of the metal.

With such capacitors it is necessary to render certain areas of the dielectric or carrier strip free of metal. Thus, in the case of roll capacitors comprising more than one length of dielectric strip each metallised on one face and wound together, or when the dielectric is metallised on both faces, this is normally done to provide a metal-free edge margin or margins in order to prevent short-circuiting between different metal layers over the edges of the strip, as explained in British Patent No. 563,080. Again, in the case of a capacitor wound from a single strip of dielectric bearing a castellated pattern of metallised areas to provide two electrodes on one surface, as described in British Patent No. 674,573, a narrow deviating metal-free band must be obtained along the strip.

Hitherto, metal-free areas have been obtained by electrical demetallising technique in the manner described in the specifications of the above-mentioned patents. It has also been proposed to achieve a similar effect by masking selected areas of the strip during deposition of the metal coating.

The present invention contemplates the forming of metal-free areas on the metal coated dielectric or carrier strip by the action of a chemical reagent or reagents. The method may comprise the steps of first completely metallising the dielectric or carrier strip over at least one surface, removing the undesired areas of metal by treating them selectively with a chemical reagent or mixture of reagents which will attack or dissolve the metal without significantly affecting the dielectric or carrier material, and then removing the residual products of the reaction and any excess of reagent by washing.

There are a variety of reagents that will attack thin metal films, for example hydrochloric acid, sodium hydroxide and so forth, but the preferred reagent in the present connection is sodium hydroxide. The metal coating may be of aluminium carried on a dielectric strip of polyethylene terephthalate.

The following is a description of one method of carrying the invention into effect, given by way of example. The flexible strip material to be treated is polyethylene terephthalate dielectric which has been previously metallised with aluminium all over one face. The strip is drawn off from a supply spool whence it passes over a guide roller and then through the nip between a transfer roller and a backing roller which keeps the strip in contact with the transfer roller. The transfer roller is below the backing roller and its lower part dips into a bath of 60% sodium hydroxide solution. The strip passes with its metallised surface against the transfer roller, and the cylindrical surface of the roller bears a pattern in relief, the raised parts of the pattern corresponding to those areas of the roller surface that come into contact with the areas of the strip that it is desired to demetallise. Therefore, said areas of the strip have applied to them a film of the sodium hydroxide reagent drawn up from the reagent bath by the transfer roller.

The strip passes on to a tank of wash water but before it enters the wash tank the sodium hydroxide demetallising reagent has time to act on the metallisation and dissolve it at those places which have been coated with the reagent. The residue of the reaction and any excess sodium hydroxide is mainly removed in the wash tank, and the washing is completed by water sprays which are directed on to the surfaces of the strip as it leaves the wash tank. These sprays are positioned above the wash tank so that the water from them replenishes the tank which has a continuous overflow to prevent it from containing too high a concentration of reaction products and unused reagent.

Afterwards, the strip is passed through a drying chamber and then wound on to a take-up spool which can subsequently be used as

a supply reel in the manufacture of roll capacitors.

Increased production is obtained by treating a wide web of the strip material by employing a plurality of transfer rollers side by side, or a single long roller bearing a plurality of patterns, and afterwards slitting the web longitudinally into individual strips.

The solution of sodium hydroxide reagent may, if desired, have its viscosity increased, for example by the addition of a substance such as sodium silicate to improve the adherence of the reagent to the metallised areas of the strip and give a cleaner edge to the demetallised areas; preferably the viscosity is increased to a value somewhat greater than 800 centistokes. In this way a clean sharp pattern of demetallised areas is obtained which compares favourably with results achieved by electrical demetallisation or masking.

The dielectric or carrier strip bearing the metallisation need not be polyethylene terephthalate, but can be any other synthetic plastic material, or indeed any flexible strip insulating material that has sufficient resistance to the action of the demetallising reagent. Paper strip can be treated if the surfaces of the paper are first suitably protected by a coat of lacquer or varnish. It is also to be noted that this chemical method can be used to treat comparatively rough-surfaced strip materials which would not be amenable to treatment by electrical demetallisation; for example, woven material such as a strip of glass cloth could be used for carrying the metallisation.

It will be understood that the speed at which the strip or web can be run through the demetallising apparatus is governed by the consideration that sufficient time must be given for the demetallising reagent to act during the passage of the strip between the transfer roller and the wash tank. Consequently, if this distance is increased the apparatus can be speeded up without affecting the quality of the demetallisation.

There are methods other than that already described for applying the demetallising reagent to the selected areas on the strip. Thus, if the viscosity of the reagent were adjusted to be of the same order as that of printers ink, it would no doubt be possible to employ any of the conventional methods of application from rolls or plates that are used in the printing industry, or silk screen printing could be employed. Another way would be to protect the areas of the strip on which the metallisation was to be retained by the application of a lacquer or varnish, and then to pass the whole of the strip through the reagent bath.

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840,542 COMPLETE SPECIFICATION

1 SHEET

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